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Garney

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[54] **APPARATUS FOR MOUNTING A SENSING DEVICE IN A WELL LOGGING INSTRUMENT**

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[51] **Int. Cl.**[3] **E21B 47/00**

[52] **U.S. Cl.** **73/151**

[58] **Field of Search** 73/151, 152, 712, 714; 367/25, 81; 250/256

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,939,705	2/1976	Glotin et al.	73/151
4,120,198	10/1978	Tanguy et al.	73/151

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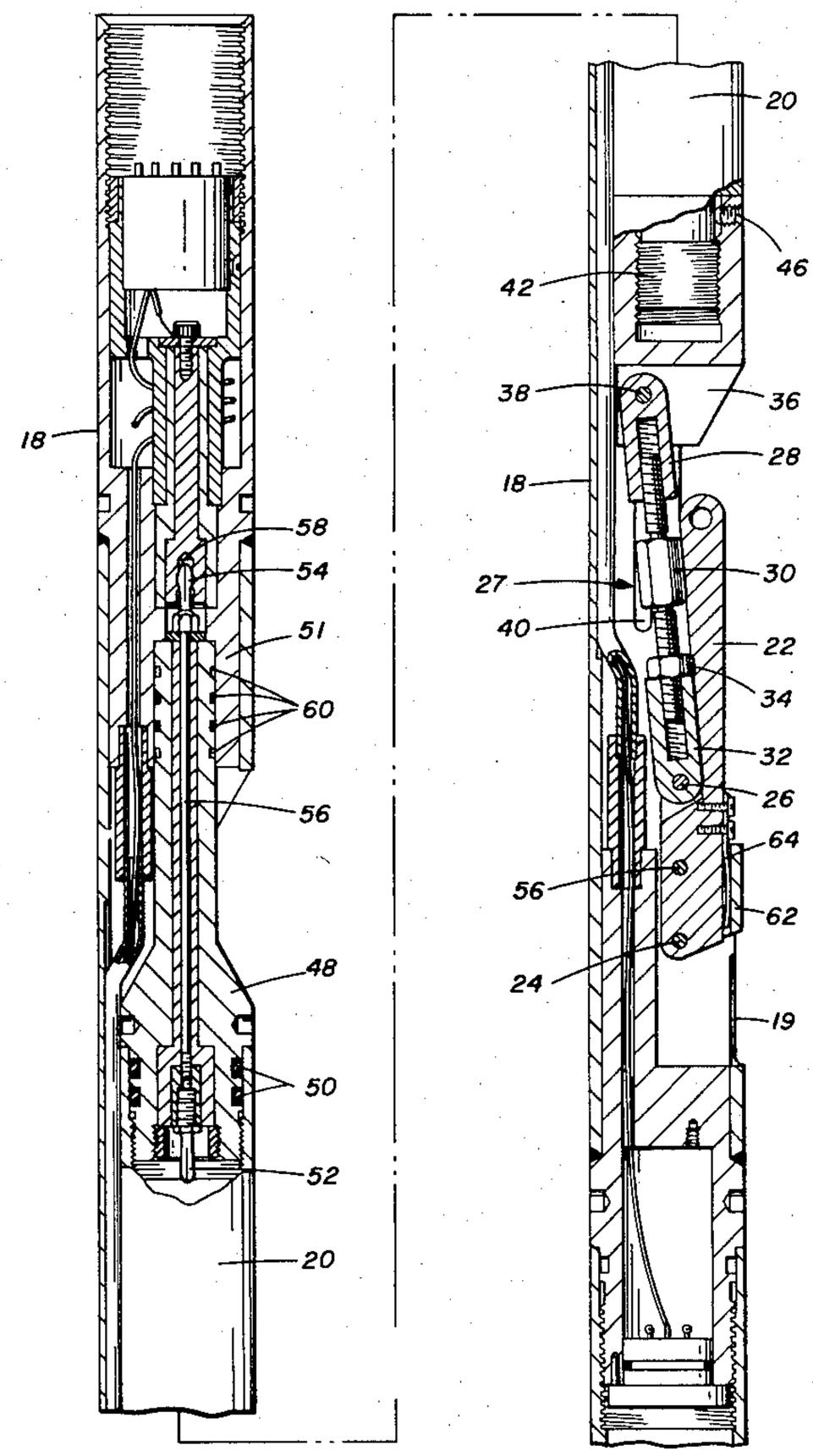
[57] **ABSTRACT**

An elongated housing of a well logging instrument having a lever latch and positioning mechanism attached to a carriage and a snorkel and barrel assembly. One end of the sensing device is mounted on the carriage and the snorkel is affixed to the opposite end. The latch and positioning mechanism allows the assembly to be moved until the snorkel enters the barrel and retains it in place. The mechanism is then secured in place. The mechanism contains an indicator which is visible if the mechanism is not in position to be secured. Electrical signals are passed from the sensing device, through the snorkel to an electrical connector at the end of the barrel and through a cable to the earth's surface.

6 Claims, 3 Drawing Figures



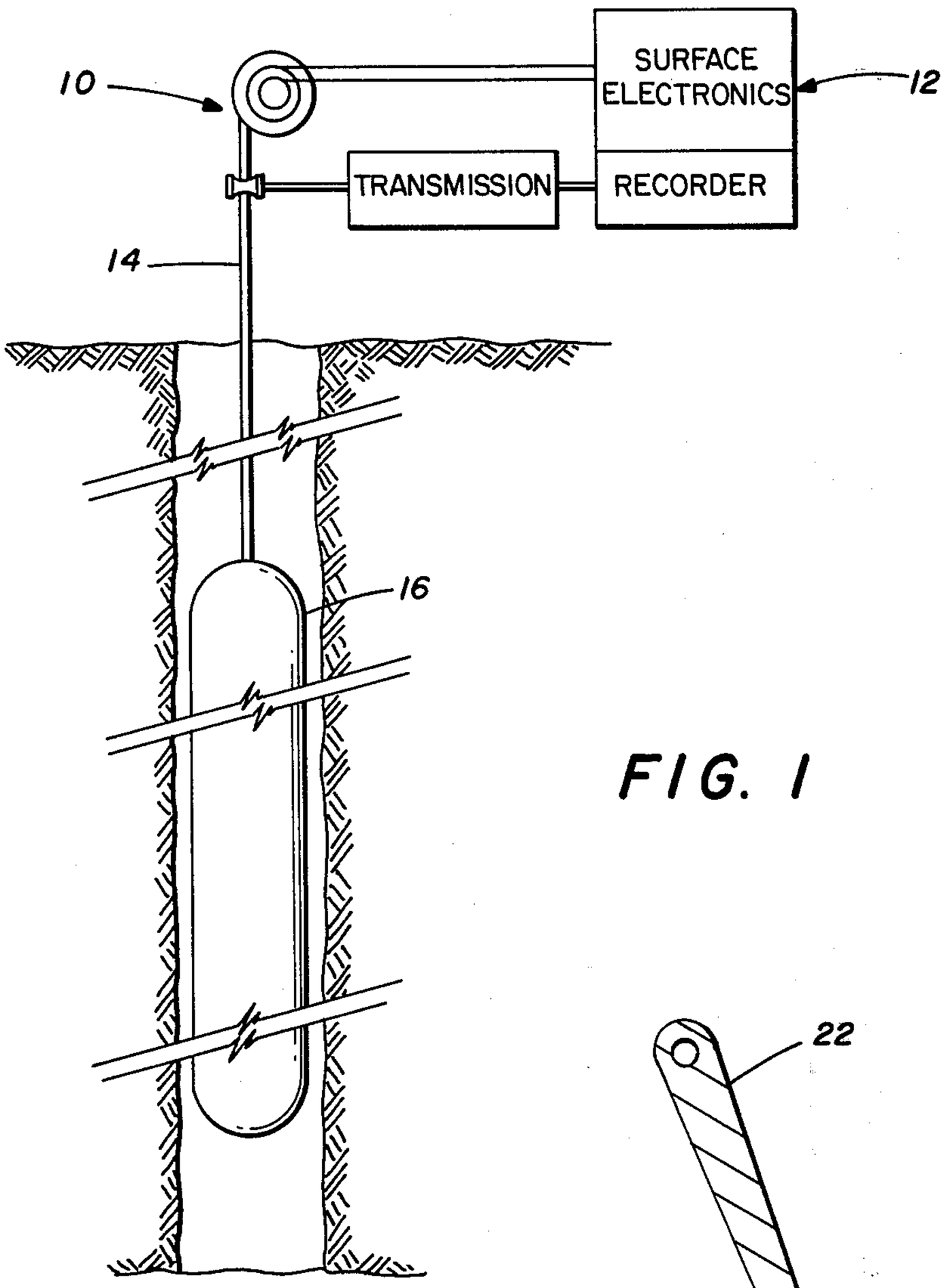
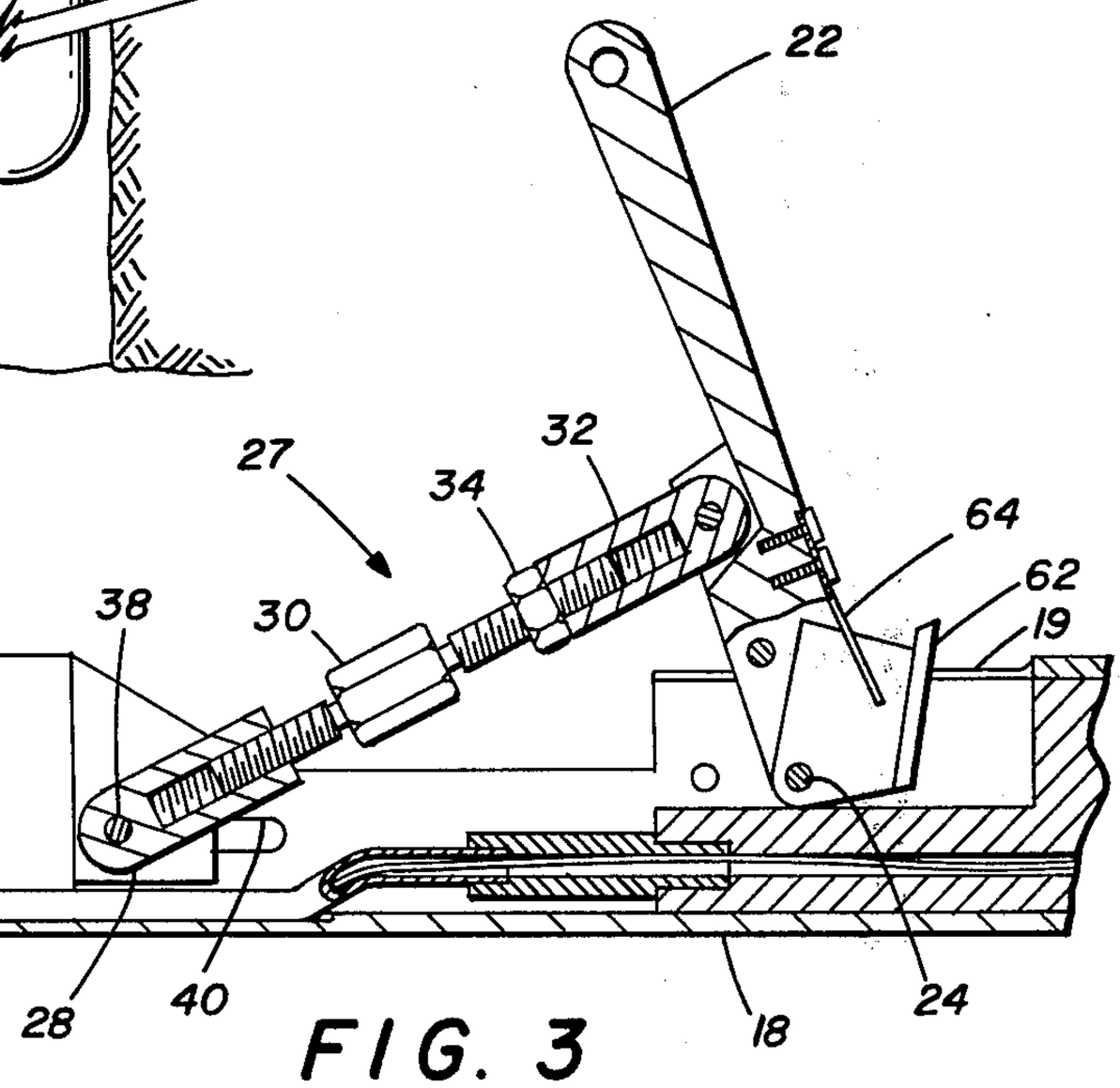

10
SURFACE ELECTRONICS
12
TRANSMISSION
RECORDER
14
16

FIG. 1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27
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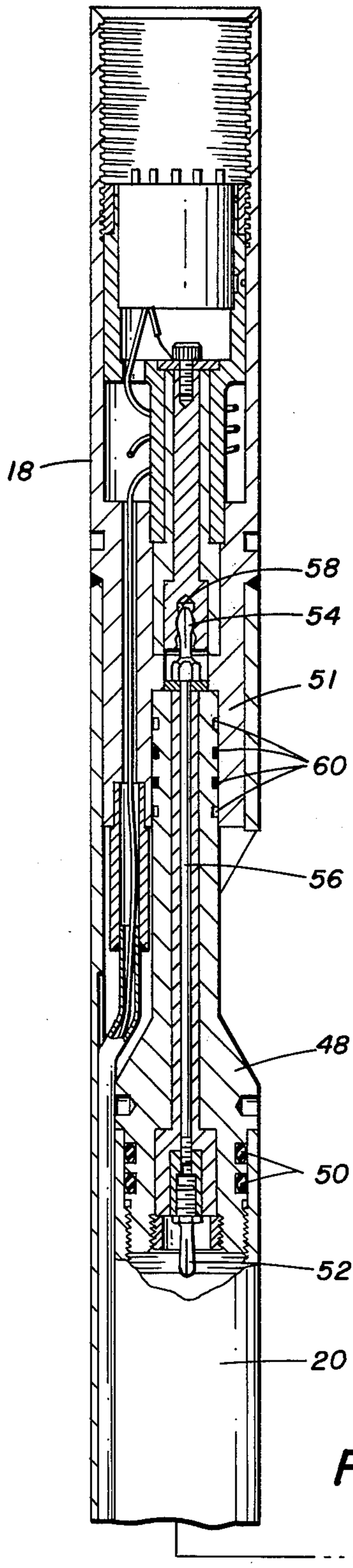
28
18

FIG. 3


18
58
54
51
60
56
48
50
52
20

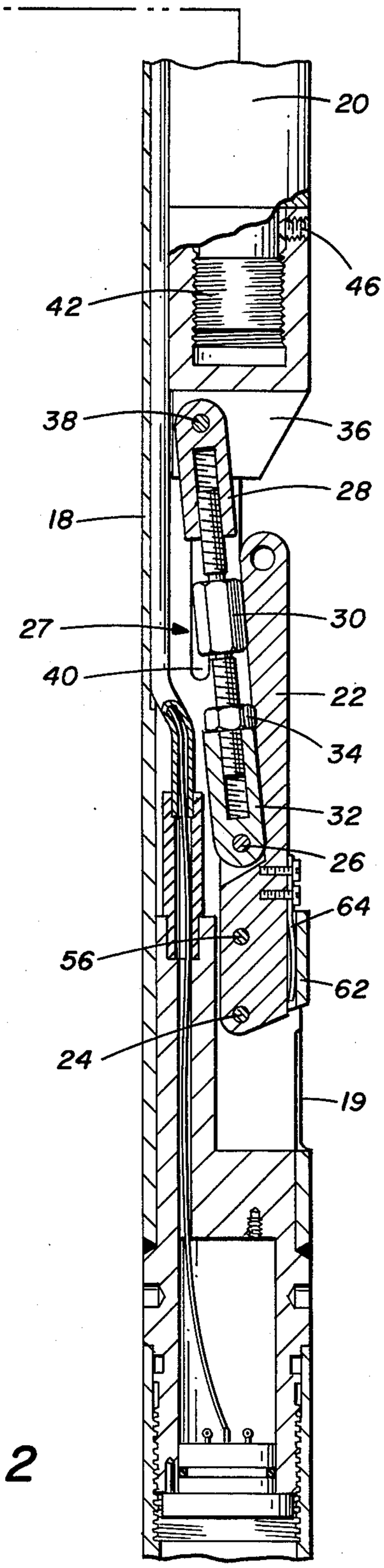

20
42
46
38
36
28
18
27
30
40
22
34
32
26
64
56
62
24
19

FIG. 2

APPARATUS FOR MOUNTING A SENSING DEVICE IN A WELL LOGGING INSTRUMENT

BACKGROUND OF THE INVENTION

This invention relates generally to apparatus to support a sensing device in a well logging tool and more specifically an apparatus to support a pressure-sensing device in a well logging tool.

In the development of oil and gas and other similar wells it is often necessary or desirable to detect the pressure in the borehole at all depths. This type of measurement is accomplished by lowering a pressure-sensing device into the well in a logging tool or instrument. The device communicates electrical signals representative of the downhole pressure to the surface via the logging instrument support cable. This pressure sensing device is supported in a housing both for physical protection and to provide some means to transfer the electrical signals from the device to the cable. These pressure-sensing devices are quite delicate to physical shock and abuse, thus they must be removed from the logging tool after each use. When these pressure-sensing devices are removed from a logging tool they are cleaned and they are transported in a protective case.

Apparatus for supporting these devices have been in use in the industry for many years. These apparatus typically require the pressure-sensing device to be joined to the housing by bolts immediately prior to their use. These apparatus are not only subject to deterioration from exposure to the well environment, but assembly and disassembly became time consuming and difficult. Thus, merely assembling the logging instrument for use can damage the pressure-sensing devices, thus possibly rendering them inoperable or requiring repair prior to use.

Accordingly, the present invention overcomes the deficiencies of the prior art by presenting a simple mechanical apparatus allowing for the simple installation and removal of a sensing device in a well-logging tool with a minimum possibility for damaging it.

SUMMARY OF THE INVENTION

An apparatus to retain a sensing device in a well logging tool, having an elongated housing and a locking and positioning mechanism coupled with a snorkel and barrel assembly designed to allow ease of removal of the sensing device from the housing. The housing has a longitudinal opening to allow for interface between the sensing device and the well environment and to facilitate removal of the device from the housing after use.

The first end of the sensing device is mounted on a carriage which is slidably retained by the housing. The second end of the device is fitted with a snorkel which is slidable within a barrel portion of the housing. The latch and positioning mechanism allows the carriage and sensing device to be moved until the snorkel enters and occupies the barrel. The mechanism is then latched in place, thereby retaining the second end of the sensing device within the housing. The latch and positioning mechanism includes a visual indicator to indicate if the mechanism is not latched and thus not ready for use in the well. The snorkel contains a means for passing electrical signals from the sensing device to an electrical connector at the end of the barrel. These electrical signals are then conducted to a cablehead at the upper

end of the logging tool, and over a cable to electrical apparatus at the earth's surface.

One object of this invention is to provide a pressure-sensing device mounting structure that overcomes the aforementioned disadvantages of the prior art mounting devices.

Still, one other object of this invention is to provide a sensing device mounting structure that allows for easy mounting and removal of the sensing devices in a well logging instrument so they can be mounted for use and removed for cleaning, storage, and transportation.

Various other objects, advantages and features of this invention will become apparent to those skilled in the art from the following discussion, taken in conjunction with the accompanying drawings, in which:

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic pictorial representation of a well or earth borehole being logged with a logging instrument therein and associated equipment at the earth's surface including a hoist and associated surface electronics for the logging instrument;

FIG. **2** is a cutaway elevation view of a portion of a well logging instrument having the mounting apparatus of this invention with the pressure-sensing device secured in place for use; and

FIG. **3** is a cutaway elevation view of a portion of the latching mechanism shown in FIG. **2** with the latching mechanism positioned for removal of the pressure-sensing device.

The following is a discussion and description of preferred specific embodiments of the mounting apparatus of this invention, such being made with reference to the drawings, whereupon the same reference numerals are used to indicate the same or similar parts of the structure. It is to be understood that such description is not to unduly limit the scope of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to FIG. **1** of the drawings in more detail, there is illustrated a well penetrating a portion of the earth, shown in vertical section. At the earth's surface is the operating equipment shown schematically and including a hoist **10** and the assorted electrical apparatus **12**. In the well is an elongated logging instrument **16** containing the pressure-sensing device or pressure sensor **20**. A cable **14** extends from the hoist at the earths surface and provides electrical connection between the surface electronics and apparatus **12** and the pressure-sensing device as well as providing physical support for the apparatus within the well.

Referring to FIG. **2** of the drawings, the apparatus shown therein is representative of one configuration of the sensing device retainer or sideloader apparatus of this invention. The sensing device retainer contains an elongated housing **18** with a longitudinal cross section removed forming an opening **19** to allow interface between the pressure-sensing device and the well environment. The retainer apparatus further contains a mechanism for mounting pressure-sensing device **20** in housing **18**.

Located near the distal end of the housing is a lever **22** which pivots around pivot pin **14**. Attached to lever **22** by means of another pivot pin **26** is a turnbuckle-like adjustable linkage indicated generally at **27** and comprised essentially of an upper end piece **28**, an adjusting piece **30**, a lower end piece **32** and a locking nut **34**. The

purpose of this adjustable linkage is later described in the discussion of initial adjustment of the retainer apparatus. Lower end piece **32** of this linkage contains an internally threaded portion and a yoke by which it is attached to lever **22** by means of pivot pin **26** as described above. Threaded into lower end-piece **32** is adjusting piece **30** which is similarly threaded into upper end-piece **28**. Threaded onto adjusting piece **30** is locking nut **34**. Upper end-piece **28** contains one or more flanges which mate with complimentary flanges on a carriage **36** and are attached thereto by means of pivot pin **38**. Carriage **36** is slidable within housing **18**, being retained by pivot pin **38** which is slidable in a pair of elongated slots **40** or grooves in opposing side portions of housing **18**.

As lever **22** is rotated away from housing **18** it acts upon adjustable linkage **27**, which in turn acts upon carriage **36**, drawing it towards the distal end of housing **18**. Carriage **36** may be rotated around pivot pin **38** until its' internally threaded portion is positioned to be accessable through housing opening **19**. The first or lower end **42** of pressure sensor **20** is threadably joined to carriage **36** until the mating surfaces contact. This contact is then secured by set screw **46**.

The second or upper end portion of pressure-sensor **20** is threadably joined to snorkel **48**. The non-threaded mating surface of snorkel **48** contains one or more o-ring grooves containing o-rings **50** to form a fluid-tight seal between the pressure sensor and the snorkel. Snorkel **48** contains an electrical cable for conducting electrical signals from pressure sensor **20**. The embodiment shown here consists of two insulated electrical connectors **52** and **54**, one at each end of snorkel **48** joined by insulated electrically conductive wire **56**.

The carriage **36** and attached pressure sensor **20** with snorkel **48** are pivoted around pivot pin **38** until they lie against and parallel to housing **18**. As lever **22** is rotated back to its original position it acts upon adjustable linkage **27**, which acts upon carriage **36**, sliding it toward the proximal end of housing **18**. The upper portion of snorkel **48** is slidable within barrel **51**, enters barrel **51** and moves within it until lever **22** is returned to its' original position, whereupon lever **22** is secured in place with locking pin **56**. Upper barrel electrical connector **54** makes contact with mating connector **58** which is electrically joined to cable **14**. The mating exterior surface of snorkel **48** has one or more grooves fitted with o-rings **60** to provide a fluid-tight seal when snorkel **48** has been introduced into receptacle barrel **51**.

As the invention is operated in the well, electrical signals from pressure-sensing device **20** are transmitted to lower barrel connector **52**, through the conductive connections described above to a cablehead at the top portion of logging instrument **16** and over cable **14** to the control and complimentary display and/or recording apparatus at the earth's surface.

FIG. **3** shows adjustable linkage **27** and associated portions of the adjacient structure with lever **22** in a raised position. This is the position assumed by the linkage **27** and carriage **36** when pressure-sensor **20** is either being inserted into or removed from the logging instrument. In the following description, reference can be made to FIG. **3** for understanding of operation of this mechanism.

The initial fitting of pressure-sensing device **20** to the sensing device retainer apparatus is done by way of adjustable linkage **27**, with lever **22** rotated away from housing **18** through opening **19** and snorkel **48** thus retracted from barrel **51**. Adjusting piece **30** is rotated until the threads extend the linkage to its maximum extension. Lever **22** is then activated to thrust snorkel **48** into barrel **51**. The opposing mating surfaces of barrel **51** and snorkel **48** should contact before lever **22** reaches a fully closed position. Adjusting piece **30** is rotated, in a reverse manner from above, shortening the linkage until lever **22** may be fully closed and secured with locking pin **56**.

Before the tool is used in the well the locking and positioning mechanism must be secured against the housing. The retainer apparatus also has an indicator to indicate whether or not this has been done and the tool is ready for operation. One such embodiment of an indicator is shown in FIG. **2** consisting of a warning flag **62** designed to visibly extend from the housing **18** when not secured by locking pin **56**. Flag **62** pivots upon the same axis as lever **22** and is secured by locking pin **56** being inserted in consecutive complimentary holes in lever **22**, flag **62**, and housing **18**. If locking pin **56** is not in place, securing lever **22** and flag **62**, in a retracted position, spring **64** acts upon flag **62** causing it to rotate around pivot pin **24** and protrude perpendicularly from opening **19** in housing **18**.

To assemble the tool for use in the well, lever **22** is rotated away from housing **18** then acting upon adjustable linkage **27** and carriage **36**, drawing them toward the distal end of housing **18**. Carriage **36** is rotated around pivot pin **38** until its threaded surface faces away from housing **18**. The pressure-sensing device **20** is then threadably connected to the carriage **36** and secured in place by tightening set screw **46**. This carriage **36** and attached pressure-sensor **20** with snorkel **48** is then rotated back against and parallel to housing **18**. Lever **22** is then rotated back against housing **18** causing the unit to move toward the proximal end of the tool. As a result of this movement, snorkel **48** will enter barrel **51** and move within it until lever **22** is returned to a closed position. Indicator flag **62** is manually closed against the housing and, along with lever **22**, is secured in place by locking pin **56**. Disassembly of the tool after use is the exact reversal of the above procedure.

Many modifications and variations besides those specifically mentioned may be made in the techniques and structures described herein and depicted in the accompanying drawings without departing substantially from the concept of the present invention. For example, the described configuration of the adjustable linkage yoke end fitting could be replaced with fittings of a ball and socket type design or provisions could be made for multiple electrical contacts at the top of the snorkel coupled with a means for properly orienting the same. Accordingly, the forms of the invention described and illustrated herein are exemplary only and are not intended as limitations on the scope of the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a well logging system having a logging instrument containing a removable sensing device, a means to pass said logging instrument through an earth borehole, and electronic apparatus in said logging instrument and at the earth's surface to operate and monitor said sensing device, an improvement, comprising:

(a) a carriage means longitudinally movable mounted in said logging instrument and removably mountable with one end portion of said sensing device;

(b) a latch and positioning mechanism mounted to said logging instrument and operably connected to said carriage means to displace same between a secured position permitting use of said logging instrument and a released position permitting removal of said sensing device; and

(c) connection means operably removably mountable with said sensing device and operably mountable with an electrical connector means in said logging instrument; and

(d) mount means in said logging instrument adapted to removably mount in a fixed position another end portion of said sensing device.

2. An apparatus to mount a pressure-sensing device in a logging tool in a well, comprising:

(a) an elongated housing with a longitudinal opening;

(b) a latch and positioning mechanism mounted on the housing;

(c) a carriage moved by the latch and positioning mechanism and providing mounting and support for a first end of the pressure-sensing device and allowing such first end to be disconnected from said latch and positioning mechanism;

(d) a snorkel attached to a second end of the pressure-sensing device containing a means for transferring electrical signals generated in the pressure-sensing device;

(e) a barrel portion of said housing into which said snorkel is mountable, providing a securing means for said second end of said pressure-sensing device and containing a means for picking up the electrical signals from the snorkel and transmitting them to an electrical circuit means in said logging tool; and

(f) a contact block which receives the electrical signals from said barrel portion and provides a means by which the signals may be conducted to a logging cable connectable to said logging tool.

3. The mount apparatus of claim **2**, wherein said latch and positioning mechanism comprises:

(a) a lever pivotally mounted to said housing;

(b) a longitudinally adjustable lengthwise linkage attached between said lever and said carriage including two threaded end-pieces, threadably joined to a complimentary threaded adjusting piece and a means for locking the end pieces and adjusting piece in relative position to one another; and

(c) a locking pin to secure said lever in a retracted position within said housing.

4. The latch and positioning mechanism of claim **3**, comprising:

a visual indicator means indicative of said latch and positioning mechanism being in condition for being secured in place to said housing which is visible unless said latch and positioning mechanism is secured in a retracted position against said housing.

5. The mount apparatus of claim **2**, wherein said snorkel comprises;

a first end threadably mountable with said pressure-sensing device and containing an electrical connector conductively joined to another electrical connector on the second end of said snorkel for passing electrical signals from the pressure-sensing device through said snorkel.

6. An apparatus to mount a pressure-sensing device in a logging tool in a well, comprising:

(a) an elongated housing with a longitudinal opening in a mid-portion thereof;

(b) a lever pivotally mounted in said housing;

(c) a linkage means attached to and movable by said lever;

(d) a carriage attached to and moved by said linkage means including a threaded portion adapted to mount the first end of a pressure-sensing device;

(e) means for slidably retaining said carriage within said housing;

(f) a snorkel attached to the second end of the pressure-sensing device and containing an electrical connector at each end electrically conductively joined;

(g) a barrel having an opening therein into which said snorkel is slidably mountable including an electrical connector complimentary with said electrical connector at the upper end of said snorkel whereby the two connectors will mate when said snorkel is fully inserted into said barrel;

(h) an electrical contact block within said housing which is electrically coupled to said barrel contained electrical connector whereby electrical signals from the pressure-sensing device may be communicated to other apparatus for said logging instrument within said housing.

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